



CLIMATE AND SPACE  
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# CCMC: Successes and Challenges

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# Successes: Provide access to advanced simulations for the space science community

- **CCMC dramatically changed the way space physics science is done.** Before CCMC it was difficult for data analysts or paper and pencil type theorists to use advanced numerical simulations to test their ideas or put in-situ observations into global context. CCMC provided easy access to advanced simulation tools and this had a tremendous impact on the space physics community.
- The present situation with advanced numerical simulations is similar to NASA's open data policy: after a short proprietary period all satellite data are available to the entire community. Similarly, **CCMC makes the simulation results obtained by the best codes available to community.** However, just as the instrument blueprints are proprietary, the source codes are also proprietary. The big change is that now the solution algorithms are published, just as the basic instrument descriptions are published. This way CCMC's impact is that simulation tools and observational data are – finally – on the same footing.

# Successes: Test physics-based space weather models in a quasi-operational environment

- CCMC is leading the effort to rigorously measure the performance and improvements of major space weather models.
  - The workshop in Florida is a milestone in this direction and it can provide a broad international “buy-in.”
- CCMC also supports NASA’s missions with space weather models. It is difficult to evaluate the success of this work from the outside

# Successes: Be a trusted partner of code developers

- When CCMC started there was great suspicion among the developers of major space plasma simulations codes. The main concern was the protection of proprietary information about codes. At this time even the main computational algorithms were mostly treated as trade secrets. CCMC made an agreement with the code developers promising three things:
  - No source code will be shared with anyone outside of CCMC,
  - CCMC will not modify any code developed outside of CCMC without the explicit permission of the code developer, and
  - There will be no direct comparison of code results.
- As time went on and trust was built between CCMC and the code developers the third point gradually faded and CCMC did carry out code comparisons (such as the Geospace model selection for NOAA/SWPC). The first two agreements, however, are still very much alive and they are at heart of the success of CCMC. Violating these would result in the loss of most leading physics-based codes that are the bread-and-butter of CCMC

# Challenges: Model Sunset

“The Panel encourages the CCMC to develop a published set of criteria that will determine which models are selected for incorporation into the RoR capabilities of the CCMC. The publication of these criteria would help manage community expectations. In addition, the Panel finds that the CCMC would benefit from intermittent internal assessments of both the demand for and the impact of each model in the RoR suite to determine whether continuing support is warranted. The assessment should apprise both the quality and quantity of each model’s impact.”

CCMC Programmatic Review, 2017

# Challenges: Mission Creep

- Political challenge
  - By law NOAA/SWPC is responsible for civilian space weather forecasting, but .....
  - M NASA has much more resources for space weather missions and programs
  - M NASA has mission critical space weather needs
    - For such needs “build or buy” dilemma is usually “build”
  - M NOAA does not have an extramural space weather research program
    - Community support is usually “bought”
    - Challenging to influence research directions
- CCMC’s mistaken response was to displace SWPC
  - Fortunately this mistake was recognized and corrected
  - There is still lingering mistrust
  - CCMC must scale back the “experimental forecast”
  - M Too resource intensive
  - M Politically unhelpful ... whatever the public statements
- SWPC’s smart response is a takeover of the “deep state”
  - Bill Murtagh, Terry Onsager ... and Steve Clarke
  - SWAP, etc....

# Challenges: Oversight

“The CCMC currently functions as an entrepreneurial research group inside a government center. While the CCMC director reports to a nominal chain of command at NASA Goddard Space Flight Center (GSFC), in practice the center operates as an independent organization. The reason is that the CCMC is directly funded by the Heliophysics Division of NASA headquarters (HQ) and by NSF, and only one full time equivalent (FTE) out of more than a dozen CCMC staff is funded by GSFC (and this FTE is funded by the Director’s Discretionary fund). This management structure results in the CCMC being a more agile and responsive organization than the typical NASA group that serves the space physics community. At the same time, its presence within GSFC provides advantages from both infrastructure and local talent perspectives. The CCMC’s agility and flexibility, as well as its leadership and staff, are highly appreciated by the community and by this review panel.”

CCMC Programmatic Review, 2017

# Summary

- CCMC is a great success and needs to be continued
  - Community access to state-of-the-art codes
  - Testing and validating advanced models
- CCMC must keep the trust of the model developers
- CCMC needs effective oversight and guidance
- CCMC must “sunset” unused/old models